APPENDIX B

Scenarios

This appendix contains a set of lab scenarios, each of which contains some type of problem statement that you need to solve. Some scenarios ask specific questions. Others ask that you configure the devices in a network. Some scenarios give you command output from a working network, and ask that you decipher the output to describe the current status in the network, or figure out a problem in the network. In any case, these scenarios help you exercise your knowledge of Cisco network designs, configuration commands, and **show** commands.

The scenarios revolve around the coverage in Chapters 7, 8, 9, and 12 in this book (the *CCNA INTRO Exam Certification Guide*). To keep them organized, the scenarios are numbered with the corresponding chapter number in the first part of the scenario number. Table B-1 lists the scenarios found in this appendix.

Table B-1 *List of Scenarios in this Chapter*

Scenario Number	Chapter which covers the topics	Description
1	7	Configuration Comparisons
2	7	More Configuration Comparisons
3*	8	LAN Switch Basic Configuration
4	9	Broadcast and Collision Domain Analysis
5	12	IP Addressing and Subnet Calculation
6*	12	Subnet Design with a Class B Network

*These labs' configurations can be performed using the special version of Boson's Netsim network simluator that comes with book CD. Refer to appendix C in the book (not the CD appendix C) for a complete list of all available hands-on exercises that can be done using Netsim.

You can either perform these scenarios as part of your final preparation for the INTRO exam, or use them at the end of each chapter. Regardless, just pick the scenarios you want to do, and dive in! For those of you wanting to do some of these scenarios using Boson NetSim, refer to appendix C in the book for more details on how to start NetSim.

Scenarios for Chapter 7

Scenario 1

Compare the following output in Example B-1 and Example B-2. Example B-1 was gathered at 11:00 a.m., 30 minutes earlier than in Example B-2. What can you definitively say happened to this router during the intervening half hour?

Example B-1 *11:00 a.m.* **show running-config**

```
hostname Gorno
!
enable password cisco
!
interface Serial0
 ip address 134.141.12.1 255.255.255.0
!
interface Serial1
 ip address 134.141.13.1 255.255.255.0
!
interface Ethernet0
 ip address 134.141.1.1 255.255.255.0
!
router rip
 network 134.141.0.0
!
line con 0
 password cisco
 login
line aux 0
line vty 0 4
 password cisco
 login
```

Example B-2 *11:30 a.m.* **show running-config**

```
hostname SouthernSiberia
prompt Gorno
!
enable secret $8df003j56ske92
enable password cisco
!
interface Serial0
 ip address 134.141.12.1 255.255.255.0
!
```

Example B-2 *11:30 a.m.* **show running-config** (Continued)

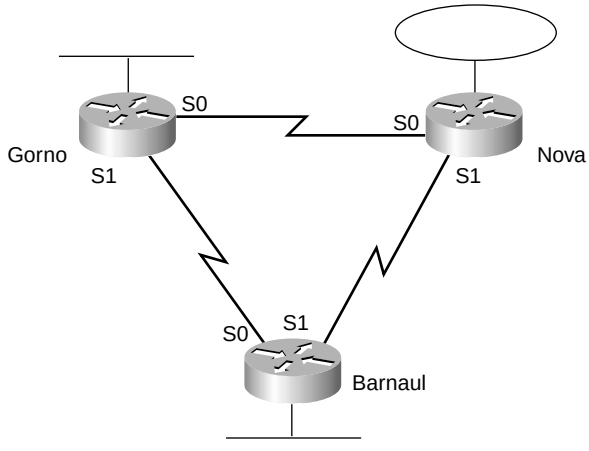
```
interface Serial1
 ip address 134.141.13.1 255.255.255.0
!
interface Ethernet0
 ip address 134.141.1.1 255.255.255.0
 no cdp enable
!
router rip
 network 134.141.0.0
!
line con 0
 password cisco
 login
line aux 0
line vty 0 4
 password cisco
 login
```

Questions on Scenario 1

1. During the process of changing the configuration in Scenario 1, the command prompt temporarily was **SouthernSiberia(config)#**. What configuration commands, and in what order, could have changed the configuration as shown and allowed the prompt to temporarily be **SouthernSiberia(config)#**?

2. Assuming that Figure B-1 is complete, what effect does the **no cdp enable** command have?

Figure B-1 *Siberian Enterprises' Sample Network*



3. What effect would the **no enable password cisco** command have at this point?

Scenario 2

Example B-3 shows that the **show running-config** command was executed on the Nova router.

Example B-3 *Configuration of Router Nova*

```
hostname Nova
banner # This is the router in Nova Sibiersk; Dress warmly before entering! #
!
boot system tftp c2500-js-113.bin 134.141.88.3
boot system flash c2500-j-l.111-9.bin
boot system rom
!
enable password cisco
!
interface Serial0
 ip address 134.141.12.2 255.255.255.0
!
interface Serial1
 ip address 134.141.23.2 255.255.255.0
!
interface TokenRing0
 ip address 134.141.2.2 255.255.255.0
!
router rip
 network 134.141.0.0
!
line con 0
 password cisco
 login
line aux 0
line vty 0 4
 password cisco
 login
```

Questions on Scenario 2

1. If this is all the information that you have, what IOS image do you expect will be loaded when the user reloads Nova?
2. Examine the following command output in Example B-4, taken immediately before the user is going to type the **reload** command. What IOS image do you expect will be loaded?

Example B-4 **show ip route** *Command Output for Nova*

```
Nova#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route


Gateway of last resort is not set

     134.141.0.0/24 is subnetted, 6 subnets
C       134.141.2.0 is directly connected, TokenRing0
R       134.141.3.0 [120/1] via 134.141.23.3, 00:00:15, Serial1
R       134.141.1.0 [120/1] via 134.141.12.1, 00:00:20, Serial0
C       134.141.12.0 is directly connected, Serial0
R       134.141.13.0 [120/1] via 134.141.12.1, 00:00:20, Serial0
                     [120/1] via 134.141.23.3, 00:00:15, Serial1
C       134.141.23.0 is directly connected, Serial1
```

3. Now examine the following **show flash** command in Example B-5, which was issued immediately after the **show ip route** command in Example B-4 but before the user issued the **reload** command. What IOS image do you think would be loaded in this case?

Example B-5 **show flash** *Command Output for Nova*

```
Nova#show flash
4096K bytes of flash memory sized on embedded flash.
File   name/status
 0 c2500-j-l.111-3.bin
[682680/4194304 bytes free/total]
```

4. Now examine the configuration in Example B-6. Assume that there is now a route to 134.141.88.0 and that the file *c2500-j-l.111-9.bin* is an IOS image in Flash memory. What IOS image do you expect will be loaded now?

Example B-6 **show running-config** *Command Output for Router Nova*

```
hostname Nova
banner # This is the router in Nova Sibiersk; Dress warmly before entering! #
!
boot system tftp c2500-js-113.bin 134.141.88.3
boot system flash c2500-j-l.111-9.bin
!
enable password cisco
```

continues

Example B-6 **show running-config** *Command Output for Router Nova (Continued)*

```
!
interface Serial0
 ip address 134.141.12.2 255.255.255.0
!
interface Serial1
 ip address 134.141.23.2 255.255.255.0
!
interface Ethernet0
 ip address 134.141.2.2 255.255.255.0
!
router rip
 network 134.141.0.0
!
line con 0
 password cisco
 login
line aux 0
line vty 0 4
 password cisco
 login
!
config-register 0x2101
```

Answers to Chapter 7 Scenarios

Scenario 1 Answers

In Scenario 1, the following commands were added to the configuration:

- **enable secret** as a global command.
- **prompt** as a global command.
- **no cdp enable** as an Ethernet0 subcommand.
- The **hostname** command also was changed.

The scenario questions' answers are as follows:

1. If the host name was changed to SouthSiberia first and the **prompt** command was added next, the prompt would have temporarily been SouthSiberia. Configuration commands are added to the RAM configuration file immediately and are used. In this case, when the **prompt** command was added, it caused the router to use Gorno, not the then-current host name SouthernSiberia, as the prompt.
2. No practical effect takes place. Because no other Cisco CDP–enabled devices are on that Ethernet, CDP messages from Gorno are useless. So, the only effect is to lessen the overhead on that Ethernet in a very small way.
3. No effect takes place, other than cleaning up the configuration file. The **enable password** is not used if an **enable secret** is configured.

Scenario 2 Answers

The answers to the questions in Scenario 2 are as follows:

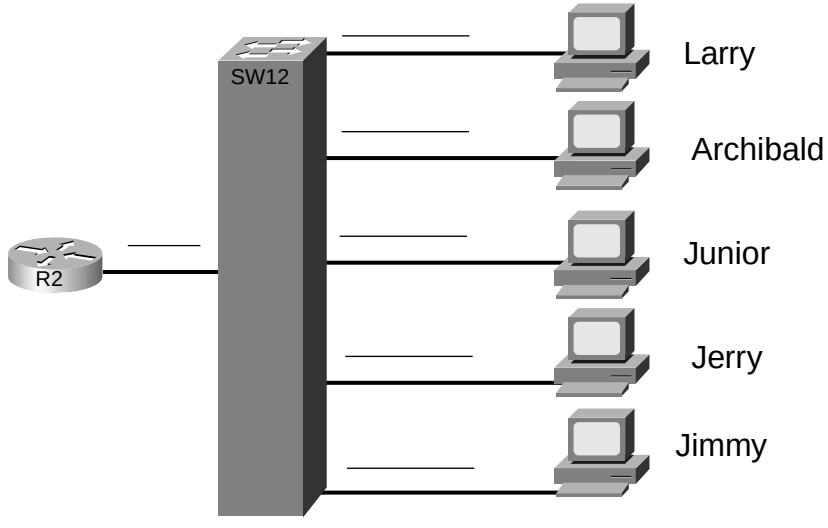
1. The first boot system statement would be used: **boot system tftp c2500-js-113.bin 134.141.88.3**.
2. The **boot system flash** command would be used. The TFTP boot presumably would fail because there is not currently a route to the subnet of which the TFTP server is a part. It is reasonable to assume that a route would not be learned 2 minutes later when the router had reloaded. So, the next **boot system** command (**flash**) would be used.
3. The **boot system ROM** command would be used. Because there is no file in Flash memory called c2500-j- l.111-9.bin, the boot from Flash memory would fail as well, leaving only one **boot** command.
4. IOS from ROM would be loaded because of the configuration register. If the configuration register boot field is set to 0x1, **boot system** commands are ignored. So, having a route to the 134.141.88.0/ 24 subnet and having *c2500-j-l.111-9.bin* in Flash memory does not help.

Scenario for Chapter 8

Scenario 3: LAN Switch Configuration

Your job is to deploy a new LAN switch at a remote site. Figure B-2 depicts the network. Perform the activities in the list that follows the diagram.

Figure B-2 *Scenario 3: Basic LAN Switch Configuration*



1. Clear the saved configuration before starting. Reload the switch so that it has no useful configuration.
2. Assign IP address 172.16.2.254, mask 255.255.255.0, to SW12. Assign it an appropriate default gateway, and configure SW12 to use a DNS, which is at 172.16.1.250.
3. Assign a host name of SW12.

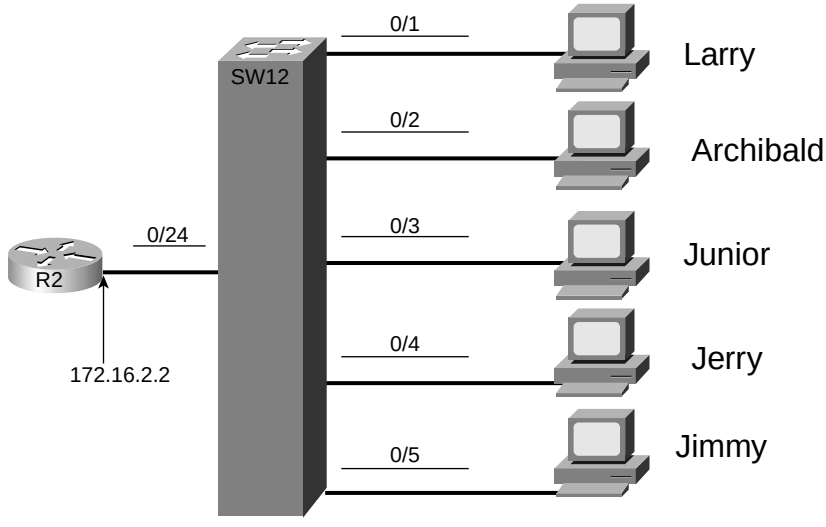
4. Choose port numbers to be used for each device, as if you were planning the physical installation. Write down these numbers on the diagram.
5. Configure so that the router uses 100-Mbps full-duplex operation.
6. Configure Archibald's MAC address so that it never leaves the address table.
7. List the commands that you would use to verify all of these features.
8. Identify the command that you would use to examine the running configuration, saved configuration, and IOS level.

Answers to Chapter 8 Scenario

Scenario 3 Answers

This scenario should have forced you to perform basic LAN configuration. Figure B-3 lists the port numbers used for the solution. Example B-7 lists the output from actually performing these steps sequentially on a 2950 series switch. An explanation of the steps follows the example.

Figure B-3 *Switch Port Numbers Used in Scenario 3 Answer*



Example B-7 *Scenario 3 Configuration and* **show** *Commands*

```
SW12#erase startup-config
Erasing the nvram filesystem will remove all files! Continue? [confirm]
[OK]
Erase of nvram: complete
SW12#reload
Proceed with reload? [confirm]

00:08:39: %SYS-5-RELOAD: Reload requestedBase ethernet MAC Address: 00:0a:b7:dc:
b7:80
Xmodem file system is available.
The password-recovery mechanism is enabled.
Initializing Flash...
```

Example B-7 *Scenario 3 Configuration and* **show** *Commands (Continued)*

```
flashfs[0]: 32 files, 6 directories
flashfs[0]: 0 orphaned files, 0 orphaned directories
flashfs[0]: Total bytes: 15998976
flashfs[0]: Bytes used: 9448960
flashfs[0]: Bytes available: 6550016
flashfs[0]: flashfs fsck took 17 seconds.
...done Initializing Flash.
Boot Sector Filesystem (bs:) installed, fsid: 3
Loading "flash:c3550-i5q3l2-mz.121-11.EA1"...flash:c3550-i5q3l2-mz.121-11.EA1: is a
directory


Error loading "flash:c3550-i5q3l2-mz.121-11.EA1"


Interrupt within 5 seconds to abort boot process.
Loading "flash:/c3550-i5q3l2-mz.121-11.EA1/c3550-i5q3l2-mz.121-
11.EA1.bin"...################################################################################
################################################################################
################################################################################
################################################################################
################################################################################


File "flash:/c3550-i5q3l2-mz.121-11.EA1/c3550-i5q3l2-mz.121-11.EA1.bin" uncompre
ssed and installed, entry point: 0x3000
executing...

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Rights clause at FAR sec. 52.227-19 and subparagraph
 (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

           cisco Systems, Inc.
           170 West Tasman Drive
           San Jose, California 95134-1706



Cisco Internetwork Operating System Software
IOS (tm) C3550 Software (C3550-I5Q3L2-M), Version 12.1(11)EA1, RELEASE SOFTWARE
(fc1)
Copyright  1986-2002 by cisco Systems, Inc.
Compiled Wed 28-Aug-02 10:03 by antonino
Image text-base: 0x00003000, data-base: 0x0071D658
```

continues

Example B-7 *Scenario 3 Configuration and* **show** *Commands (Continued)*

```
Initializing flashfs...
flashfs[1]: 32 files, 6 directories
flashfs[1]: 0 orphaned files, 0 orphaned directories
flashfs[1]: Total bytes: 15998976
flashfs[1]: Bytes used: 9448960
flashfs[1]: Bytes available: 6550016
flashfs[1]: flashfs fsck took 8 seconds.
flashfs[1]: Initialization complete.
...done Initializing flashfs.
POST: CPU Buffer Tests : Begin
POST: CPU Buffer Tests : End, Status Passed
POST: CPU Interface Tests : Begin
POST: CPU Interface Tests : End, Status Passed
POST: Switch Core Tests : Begin
POST: Switch Core Tests : End, Status Passed
POST: CPU Interface 2nd Stage Tests : Begin
POST: CPU Interface 2nd Stage Tests : End, Status Passed
POST: CAM Subsystem Tests : Begin
POST: CAM Subsystem Tests : End, Status Passed
POST: Ethernet Controller Tests : Begin
POST: Ethernet Controller Tests : End, Status Passed
POST: Loopback Tests : Begin
POST: Loopback Tests : End, Status Passed

cisco WS-C3550-24 (PowerPC) processor (revision E0) with 65526K/8192K bytes of m
emory.
Processor board ID CHK0635W02H
Last reset from warm-reset
Bridging software.
Running Layer2/3 Switching Image

Ethernet-controller 1 has 12 Fast Ethernet/IEEE 802.3 interfaces

Ethernet-controller 2 has 12 Fast Ethernet/IEEE 802.3 interfaces

Ethernet-controller 3 has 1 Gigabit Ethernet/IEEE 802.3 interface

Ethernet-controller 4 has 1 Gigabit Ethernet/IEEE 802.3 interface

24 FastEthernet/IEEE 802.3 interface(s)
2 Gigabit Ethernet/IEEE 802.3 interface(s)

The password-recovery mechanism is enabled.
384K bytes of flash-simulated non-volatile configuration memory.
Base ethernet MAC Address: 00:0A:B7:DC:B7:80
Motherboard assembly number: 73-5700-08
Power supply part number: 34-0966-02
```

Example B-7 *Scenario 3 Configuration and* **show** *Commands (Continued)*

```
Motherboard serial number: CAT0634058Q
Power supply serial number: DCA06340P5K
Model revision number: E0
Motherboard revision number: D0
Model number: WS-C3550-24-SMI
System serial number: CHK0635W02H


Press RETURN to get started!


Switch>
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface vlan 1
Switch(config-if)#ip address 172.16.2.254 255.255.255.0
Switch(config-if)#exit
Switch(config)#ip default-gateway 172.16.2.2
Switch(config)#ip name-server 172.16.1.250
Switch(config)#hostname SW12
SW12(config)#interface fastethernet 0/24
SW12(config-if)#duplex ?
  auto  Enable AUTO duplex configuration
  full  Force full duplex operation
  half  Force half-duplex operation

SW12(config-if)#duplex full
Duplex will not be set until speed is set to non-auto value
SW12(config-if)#speed 100
SW12(config-if)#duplex full
SW12(config-if)#interface fastethernet 0/1
SW12(config-if)#speed 100
SW12(config-if)#duplex auto
SW12(config-if)#
SW12(config-if)#^Z
SW12#show mac-address-table dynamic
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type       Ports
----    -----------       ----       -----
   1    0000.0c4a.8bca    DYNAMIC    Fa0/2
   1    0007.8580.71b8    DYNAMIC    Fa0/4
   1    0007.8580.7208    DYNAMIC    Fa0/3
Total Mac Addresses for this criterion: 3
```

continues

Example B-7 *Scenario 3 Configuration and* **show** *Commands (Continued)*

```
SW12#show version
Cisco Internetwork Operating System Software
IOS (tm) C3550 Software (C3550-I5Q3L2-M), Version 12.1(11)EA1, RELEASE SOFTWARE
(fc1)
Copyright  1986-2002 by cisco Systems, Inc.
Compiled Wed 28-Aug-02 10:03 by antonino
Image text-base: 0x00003000, data-base: 0x0071D658

ROM: Bootstrap program is C3550 boot loader

SW12 uptime is 5 minutes
System returned to ROM by power-on
System image file is "flash:/c3550-i5q3l2-mz.121-11.EA1/c3550-i5q3l2-mz.121-11.E
A1.bin"

cisco WS-C3550-24 (PowerPC) processor (revision E0) with 65526K/8192K bytes of m
emory.
Processor board ID CHK0635W02H
Last reset from warm-reset
Bridging software.
Running Layer2/3 Switching Image

Ethernet-controller 1 has 12 Fast Ethernet/IEEE 802.3 interfaces

Ethernet-controller 2 has 12 Fast Ethernet/IEEE 802.3 interfaces

Ethernet-controller 3 has 1 Gigabit Ethernet/IEEE 802.3 interface

Ethernet-controller 4 has 1 Gigabit Ethernet/IEEE 802.3 interface

24 FastEthernet/IEEE 802.3 interface(s)
2 Gigabit Ethernet/IEEE 802.3 interface(s)

The password-recovery mechanism is enabled.
384K bytes of flash-simulated non-volatile configuration memory.
Base ethernet MAC Address: 00:0A:B7:DC:B7:80
Motherboard assembly number: 73-5700-08
Power supply part number: 34-0966-02
Motherboard serial number: CAT0634058Q
Power supply serial number: DCA06340P5K
Model revision number: E0
Motherboard revision number: D0
Model number: WS-C3550-24-SMI
System serial number: CHK0635W02H
Configuration register is 0x10F

SW12#show running-config
```

Example B-7 *Scenario 3 Configuration and* **show** *Commands (Continued)*

```
Building configuration...

Current configuration : 1538 bytes
!
version 12.1
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname SW12
!
!
ip subnet-zero
!
!
spanning-tree extend system-id
!
!
!
interface FastEthernet0/1
 no ip address
 speed 100
!
interface FastEthernet0/2
 no ip address
!
interface FastEthernet0/3
 no ip address
!
interface FastEthernet0/4
 no ip address
!
interface FastEthernet0/5
 no ip address
!
interface FastEthernet0/6
 no ip address
!
interface FastEthernet0/7
 no ip address
!
interface FastEthernet0/8
 no ip address
!
interface FastEthernet0/9
 no ip address
```

continues

Example B-7 *Scenario 3 Configuration and* **show** *Commands (Continued)*

```
!
interface FastEthernet0/10
 no ip address
!
interface FastEthernet0/11
 no ip address
!
interface FastEthernet0/12
 no ip address
!
interface FastEthernet0/13
 no ip address
!
interface FastEthernet0/14
 no ip address
!
interface FastEthernet0/15
 no ip address
!
interface FastEthernet0/16
 no ip address
!
interface FastEthernet0/17
 no ip address
!
interface FastEthernet0/18
 no ip address
!
interface FastEthernet0/19
 no ip address
!
interface FastEthernet0/20
 no ip address
!
interface FastEthernet0/21
 no ip address
!
interface FastEthernet0/22
 no ip address
!
interface FastEthernet0/23
 no ip address
!
interface FastEthernet0/24
 no ip address
 duplex full
 speed 100
```

Example B-7 *Scenario 3 Configuration and* **show** *Commands (Continued)*

```
!
interface GigabitEthernet0/1
 no ip address
!
interface GigabitEthernet0/2
 no ip address
!
interface Vlan1
 ip address 172.16.2.254 255.255.255.0
 shutdown
!
ip default-gateway 172.16.2.2
ip classless
ip http server
!
!
!
!
line con 0
line vty 5 15
!
end

SW12#show startup-config
%% Non-volatile configuration memory is not present
```

Example B-7 begins with the startup config being deleted using the **erase startup-config** configuration. The **reload** command reinitializes the switch, so that it has no configuration either in startup configuration or the running configuration.

The IP address of the switch is configured under **interface vlan 1**, but the default gateway is configured as a global command. The duplex settings, interestingly, can only be explicitly set if all autonegotiation is disabled by explicitly setting the speed as well. The error messages were left in the example just to show that point.

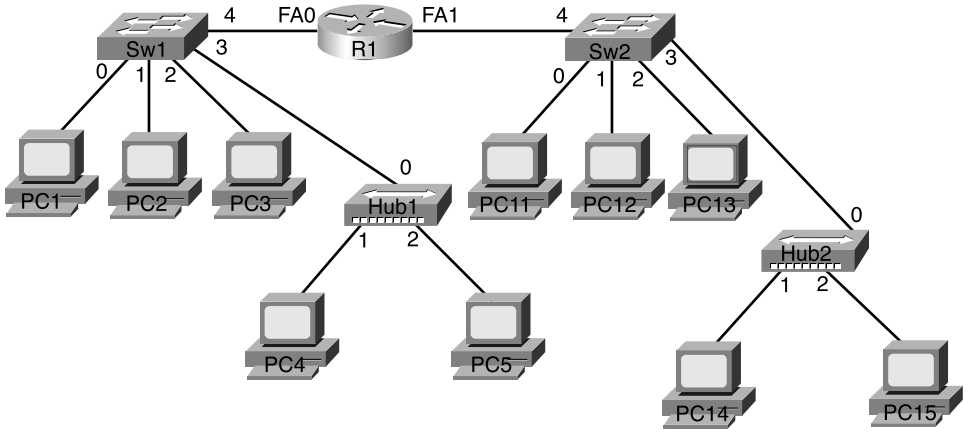
The rest of the commands in the example show the answers to the various questions. For instance, the **show running-configuration** command lists the running configuration, but the **show startup-configuration** command shows nothing, because the configuration has yet to be saved using the **copy running-configuration startup-configuration** command.

Scenario for Chapter 9

Scenario 4: LAN Switch Concepts

In this scenario, you will answer some questions about a simple network diagram. Figure B-4 depicts the network. Answer the questions that follow the diagram.

Figure B-4 *Scenario 4: Basic LAN Switch Concepts*



1. How many collision domains exist in this network?
2. How many broadcast domains exist in this network?
3. Assuming that all cards, switches, and router interfaces are 10/100 cards, how many ports total on each switch could run full duplex?
4. Assuming that all cards, switches, and router interfaces are 10/100 cards, how many ports total on each switch could run 100 Mbps?
5. The first frames to flow in this network are the following: PC5 sends an IP ARP, encapsulated in an Ethernet frame, looking for its default gateway, which is R1's FA0 interface's IP address. The Ethernet frame containing the ARP reply is the second frame.

Describe what ports each frame is sent out. Use Table B-2 to list where the frame flowed, or is draw on the diagram. If you use the table, write "received" if the frame was received in that port, or write "sent" if the frame was sent out that port.

Table B-2 *List of Hub/Switch/Router Ports for Figure B-4*

Port	Was Frame 1 Either Received in or Sent out This Port?	Was Frame 2 Either Received in or Sent out This Port?
Hub1port 0		
Hub1port 1		
Hub1port 2		
SW1port 0		
SW1port 1		
SW1port 2		
SW1port 3		
SW1port 4		
Hub2port 0		
Hub2port 1		
Hub2port 2		
SW2port 0		
SW2port 1		
SW2port 2		
SW2port 3		
SW2port 4		
R1FA0		
R1FA1		

Answers to Chapter 9 Scenario

Answers to Scenario 4

This scenario tests your recollection of a few of the core concepts for LAN switching. The answers are listed in succession:

1. Ten collision domains exist in the network for this scenario. Routers and switches separate LANs into separate collision domains, but shared hubs do not. In this diagram, each switch port and the device(s) connected to it form the individual collision domains.
2. Two broadcast domains exist in this network. Switches and hubs do not separate the LAN segments into different broadcast domains, but routers do. The two broadcast domains consist of the devices to the left of R1 and the devices to the right of R1.
3. Eight total switch ports could run full-duplex operation. Port 3 on each switch could not because there is a shared hub attached to this port, so collisions could happen. When collisions could happen, FDX is not allowed.
4. All ten switch ports could run 100 Mbps Fast Ethernet. Router FastEthernet interfaces support 100 Mbps, and the assumption was made that all the PCs support 100 Mbps. Shared hubs also can support 100 Mbps. So, all switch ports could run at 100 Mbps, but port 3 on each switch could not use full-duplex operation.
5. Figures B-5 and B-6 depict the flows of frame 1 and frame 2. Frame 1 has a source Ethernet address of PC5 and a broadcast destination address. Frame 2 has a source of R1's FA0 MAC address and a destination of PC5's MAC address. Table B-3 also describes the ports that the frames came in and out on their journeys, respectively.

Figure B-5 *Scenario 4: Path of First Frame in Question Number 5*

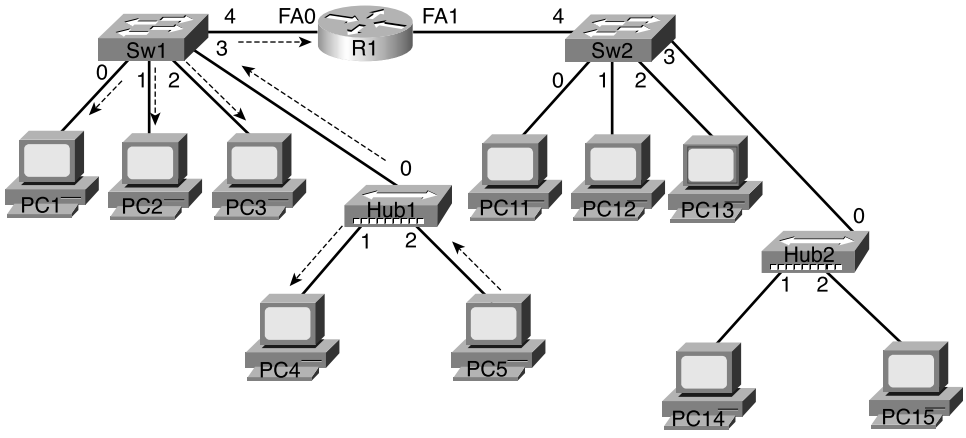


Figure B-6 *Scenario 4: Path of Second Frame in Question Number 5*

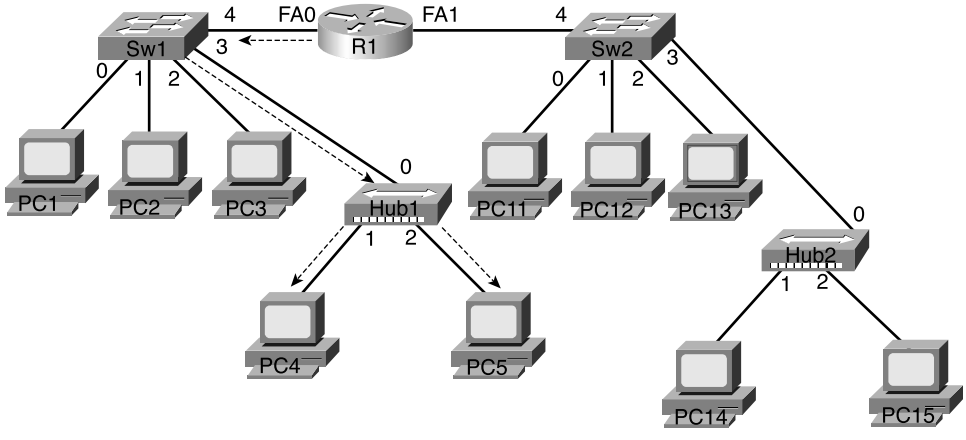


Table B-3 *Table of Incoming and Outgoing Ports for Frames in Scenario 4, Question 5*

Port	Was Frame 1 Either Received in or Sent out This Port?	Was Frame 2 Either Received in or Sent out This Port?
Hub1port 0	Sent	Received
Hub1port 1	Sent	Sent
Hub1port 2	Received	Sent
SW1port 0	Sent	

continues

Table B-3 *Table of Incoming and Outgoing Ports for Frames in Scenario 4, Question 5 (Continued)*

Port	Was Frame 1 Either Received in or Sent out This Port?	Was Frame 2 Either Received in or Sent out This Port?
SW1port 1	Sent	
SW1port 2	Sent	
SW1port 3	Received	Sent
SW1port 4	Sent	Received
Hub2port 0		
Hub2port 1		
Hub2port 2		
SW2port 0		
SW2port 1		
SW2port 2		
SW2port 3		
SW2port 4		
R1FA0	Received	Sent
R1FA1		

Frame 1 is a broadcast, so it must flow throughout the broadcast domain. So, Hub1 and Switch1 forward out all ports. R1, however, is the boundary of the broadcast domain, so R1 does not forward the broadcast. R1 replies to the ARP and encapsulates it in an Ethernet frame. This second frame has a destination of PC5's MAC address. SW1 learned that PC5's MAC is out its port 3. The hub did not learn anything because it does not keep an address table. So, R1 sends the second frame to PC5. SW1 forwards only out port 3, according to its address table. The hub still forwards out all ports.

Scenarios for Chapter 12

Scenario 5: IP Addressing and Subnet Calculation

Assume that you just took a new job. No one trusts you yet, so they will not give you any passwords to the router. Your mentor at your new company has left you at his desk while he goes to a meeting. He has left up a Telnet window, logged in to one router in user mode. In other words, you can issue only user-mode commands.

Assuming that you had issued the following commands (see Example B-8), draw the most specific network diagram that you can. Write the subnet numbers used on each link onto the diagram.

Example B-8 *Command Output on Router Fred*

```
fred>show interface
Serial0 is up, line protocol is up
  Hardware is HD64570
  Internet address is 199.1.1.65/27
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec

  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     27 packets input, 2452 bytes, 0 no buffer
     Received 27 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     29 packets output, 2044 bytes, 0 underruns
     0 output errors, 0 collisions, 28 interface resets
     0 output buffer failures, 0 output buffers swapped out
     7 carrier transitions
     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
Serial1 is up, line protocol is up
  Hardware is HD64570
```

continues

Example B-8 *Command Output on Router Fred (Continued)*

```
  Internet address is 199.1.1.97/27
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     125 packets input, 7634 bytes, 0 no buffer
     Received 124 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     161 packets output, 9575 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     4 carrier transitions
     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
Ethernet0 is up, line protocol is up
Hardware is MCI Ethernet, address is 0000.0c55.AB44 (bia 0000.0c55.AB44)
  Internet address is 199.1.1.33/27
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:00, output 00:00:00, output hang never
     Output queue 0/40, 0 drops; input queue 0/75, 0 drops
     Five minute input rate 4000 bits/sec, 4 packets/sec
     Five minute output rate 6000 bits/sec, 6 packets/sec
           22197 packets input, 309992 bytes, 0 no buffer
           Received 2343 broadcasts, 0 runts, 0 giants
           0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
           4456 packets output, 145765 bytes, 0 underruns
           3 output errors, 10 collisions, 2 interface resets, 0 restarts


fred>show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
```

Example B-8 *Command Output on Router Fred (Continued)*

```
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     199.1.1.0/27 is subnetted, 6 subnets
R       199.1.1.192 [120/1] via 199.1.1.98, 00:00:01, Serial1
R       199.1.1.128 [120/1] via 199.1.1.98, 00:00:01, Serial1
                    [120/1] via 199.1.1.66, 00:00:20, Serial0
R       199.1.1.160 [120/1] via 199.1.1.66, 00:00:20, Serial0
C       199.1.1.64 is directly connected, Serial0
C       199.1.1.96 is directly connected, Serial1
C       199.1.1.32 is directly connected, Ethernet0

fred>show ip protocol
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 23 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
 Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 1, receive any version
    Interface        Send  Recv   Key-chain
    Serial0          1     1 2
    Serial1          1     1 2
    Ethernet0        1     1 2
  Automatic network summarization is in effect
  Maximum path: 4
 Routing for Networks:

    199.1.1.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    199.1.1.66           120      00:00:04
    199.1.1.98           120      00:00:14
  Distance: (default is 120)

fred>show cdp neighbor detail
-------------------------
Device ID: dino
Entry address(es):
  IP address: 199.1.1.66
Platform: Cisco 2500,  Capabilities: Router
Interface: Serial0,  Port ID (outgoing port): Serial0
Holdtime : 148 sec
```

continues

Example B-8 *Command Output on Router Fred (Continued)*

```
Version :
Cisco Internetwork Operating System Software
IOS (tm) 2500 Software (C2500-DS-L), Version 12.2(1), RELEASE SOFTWARE (fc2)
Copyright  1986-2001 by cisco Systems, Inc.
Compiled Fri 27-Apr-01 14:43 by cmong

advertisement version: 2
-------------------------
Device ID: Barney
Entry address(es):
  IP address: 199.1.1.98
Platform: Cisco 2500,  Capabilities: Router
Interface: Serial1,  Port ID (outgoing port): Serial0
Holdtime : 155 sec

Version :
Cisco Internetwork Operating System Software
IOS (tm) 2500 Software (C2500-DS-L), Version 12.2(1), RELEASE SOFTWARE (fc2)
Copyright  1986-2001 by cisco Systems, Inc.
Compiled Fri 27-Apr-01 14:43 by cmong

advertisement version: 2
```

Scenario 6: IP Subnet Design with a Class B Network

Your job is to plan a new network. The topology required includes three sites, one Ethernet at each site, and point-to-point serial links for connectivity, as shown in Figure B-7. The network might grow to need at most 100 subnets, with 200 hosts per subnet maximum. Use network 172.16.0.0, and use the same subnet mask for all subnets. Use Table B-4 to record your choices, or use a separate piece of paper.

Figure B-7 *Scenario 6 Network Diagram*

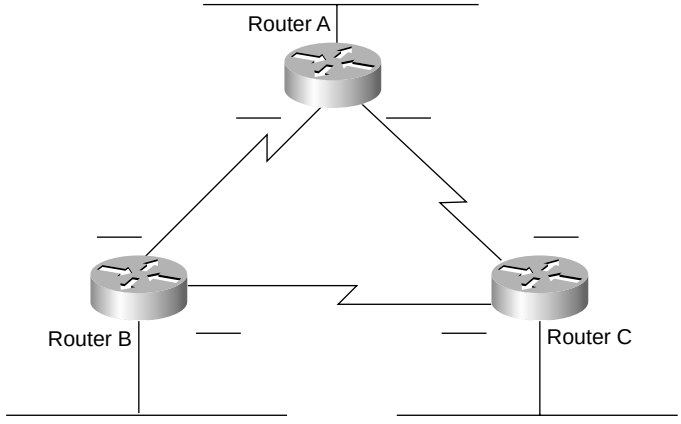


Table B-4 *Scenario 6 Planning Chart*

Location of Subnet Geographically	Subnet Mask	Subnet Number	Router's IP Address
Ethernet off Router A			
Ethernet off Router B			
Ethernet off Router C			
Serial between A and B			
Serial between A and C			
Serial between B and C			

Given the information in Figure B-7 and Table B-4, perform the following activities:

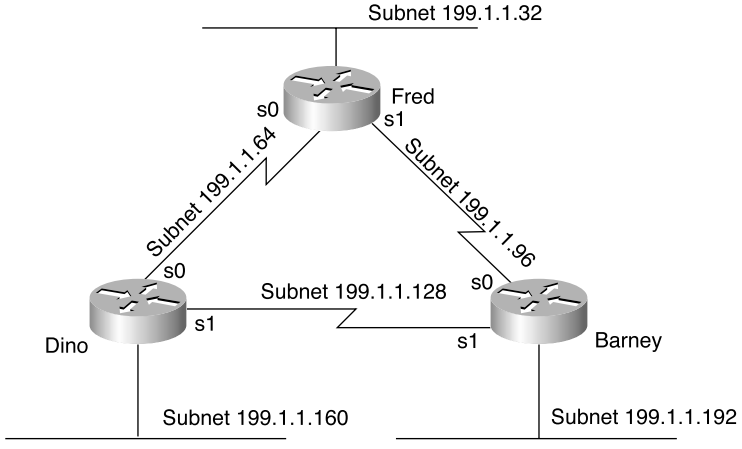
1. Determine all subnet masks that meet the criteria in the introduction to this scenario.
2. Choose a mask and pick enough subnets to use for the original topology (refer to Figure B-7).
3. Create IP-related configuration commands for each router.

Answers to Chapter 12 Scenarios

Answers to Scenario 5

Assuming that you had issued the commands in Example B-8, the most specific network diagram would look like Figure B-8.

Figure B-8 *Scenario 5 Answer—Network with Router Fred*



The clues that you should have found in the **show** commands are as follows:

- The **show interface** and **show ip interface brief** command output show the types of interfaces, as well as their IP addresses.
- The subnets could be learned from the **show ip route** command or derived from the IP addresses and masks shown in the **show interface** command output.
- The neighboring routers' IP addresses could be learned from the **show ip protocol** command.
- The neighboring routers' IP addresses and host names could be learned from the **show cdp neighbor detail** command.
- The metric for subnet 199.1.1.128/27 in RIP updates implies that both neighbors have an equal-cost route to the same subnet. Because two separate but duplicate networks would be a bad design, you can assume that the neighboring routers are attached to the same medium.

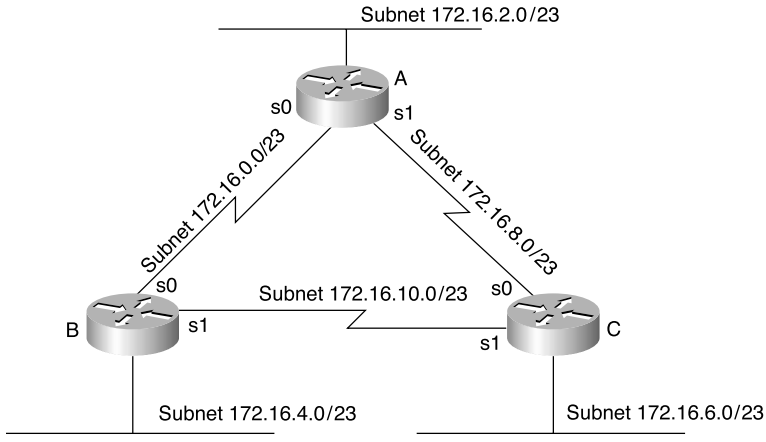
- If you are completely bored, the **telnet 199.1.1.x** command could have been issued for all IP addresses in subnets not directly connected to Fred, hoping to get a router login prompt. That would identify the IP addresses of other router interfaces.

There is no way to know what physical media are beyond the neighboring routers. However, because CDP claims that both routers are 2500 series routers, the possible interfaces on these neighboring routers are limited. Figure B-8 shows the other subnets as Ethernet segments. Similarly, the figure shows the two neighboring routers attached to the same medium, which is shown as a serial link in Figure B-8.

Answers to Scenario 6

Figure B-9 shows one correct answer for the network skeleton presented in Figure B-7.

Figure B-9 *Scenario 6 Diagram Scratch Pad*



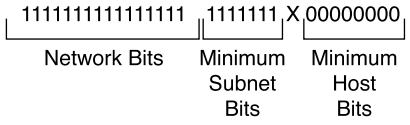
Answers to Task 1 for Scenario 6

Given the details in Figure B-7 and Table B-4 for Scenario 6, the subnet mask criteria are as follows:

- 200 hosts in a subnet, maximum
- 100 subnets, maximum
- Static size masks used all over this network

The mask must have at least eight host bits because $2^7 - 2 = 126$ is not enough and $2^8 - 2 = 254$ is more than enough for numbering 200 hosts in a subnet. The mask must have at least seven subnet bits, likewise, because 2^7 is the smallest power of 2 that is larger than 100, which is the required number of subnets. The first 16 bits in the mask must be binary 1 because a Class B network (172.16.0.0) is used. Figure B-10 diagrams the possibilities.

Figure B-10 *Subnet Mask Options for Scenario 6*



The only bit position in which a decision can be made is the 24th bit, shown with an X in Figure B-10. That leaves two mask possibilities: 255.255.254.0 and 255.255.255.0. This sample shows the 255.255.254.0 mask just so you can have a little more practice with harder masks. Given the choice in a real network, choose the easy mask!

Answers to Task 2 for Scenario 6

To choose a mask and pick enough subnets to use for the original topology illustrated in Figure B-7, a review of the longer binary algorithm and shortcut algorithm for deriving subnet numbers is required. To review, subnet numbers have the network number value in the network portion of the subnet numbers and have all binary 0s in the host bits. The bits that vary from subnet to subnet are the subnet bits—in other words, you are numbering different subnets in the subnet field.

Valid subnets with mask 255.255.254.0 are as follows:

```
172.16.0.0 (zero subnet)
172.16.2.0
172.16.4.0
172.16.6.0
.
.
.
172.16.252.0
172.16.254.0 (broadcast subnet)
```

The first six subnets, including the zero subnet, were chosen for this example, as listed in Table B-5.

Table B-5 *Scenario 6 Subnets and Addresses*

Location of Subnet Geographically	Subnet Mask	Subnet Number	Router's IP Address
Ethernet off Router A	255.255.254.0	172.16.2.0	172.16.2.1
Ethernet off Router B	255.255.254.0	172.16.4.0	172.16.4.2
Ethernet off Router C	255.255.254.0	172.16.6.0	172.16.6.3
Serial between A and B	255.255.254.0	172.16.0.0	172.16.0.1 (A) and .2 (B)
Serial between A and C	255.255.254.0	172.16.8.0	172.16.8.1 (A) and .3
Serial between B and C	255.255.254.0	172.16.10.0	172.16.10.2 (B) and .3

Answers to Task 3 for Scenario 6

Given the details in Figure B-7 and Table B-4 for Scenario 6, the configurations in Examples B-9 through B-11 satisfy the exercise of creating IP-related configuration commands for each router. These examples include only the IP-related commands.

Example B-9 *Router A Configuration, Scenario 6*

```
ip subnet-zero
no ip domain-lookup
!
interface serial0
ip address 172.16.0.1 255.255.254.0
interface serial 1
ip address 172.16.8.1 255.255.254.0
interface ethernet 0
ip address 172.16.2.1 255.255.254.0
!
router igrp 6
network 172.16.0.0
```

Example B-10 *Router B Configuration, Scenario 6*

```
ip subnet-zero
no ip domain-lookup
!
interface serial0
ip address 172.16.0.2 255.255.254.0
interface serial 1
ip address 172.16.10.2 255.255.254.0
interface ethernet 0
ip address 172.16.4.2 255.255.254.0
!
router igrp 6
network 172.16.0.0
```

Example B-11 *Router C Configuration, Scenario 6*

```
ip subnet-zero
no ip domain-lookup
!
interface serial0
ip address 172.16.8.3 255.255.254.0
interface serial 1
ip address 172.16.10.3  255.255.254.0
interface ethernet 0
ip address 172.16.6.3 255.255.254.0
!
router igrp 6
network 172.16.0.0
```